

Problem-Based Learning in the Family Sciences: A Good Fit in Theory and Practice

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ABSTRACT. Problem-Based Learning (PBL) is a good fit for pedagogy in the family sciences due to the developmental and psychological theories that overlap with key features of PBL. Vygotsky's Zone of Proximal Development (ZPD) and "authentic problem solving" are examples of theories that explain how PBL works. These learner-centered pedagogies increase engagement and motivation by helping students learn to solve real-world problems. Furthermore, PBL has been shown to enhance professional practice and preparation for students as they enter the workforce. Examples of how instructors can apply PBL in family science college classrooms are offered. Furthermore, a graphic organizer is presented to compare and contrast similarities and differences between PBL and ZPD theories. A sample worksheet that can be used in the classroom is also included. The goal of this paper is to give instructors a sufficient understanding of PBL and plausible examples of how it might be used in the classroom.

Keywords: Problem-Based Learning, family science pedagogy

One of the complaints that employers have about recent college graduates is that students are not adequately prepared for the workplace. For example, some employers have suggested that students need to learn how to solve complex, real-world problems in order to compete and navigate a global workplace (Banjeri, 2007; Meier, Hovde, & Meier, 1996). Furthermore, in the helping professions and family sciences, assisting people in solving their problems is a necessary skill. Specifically, finding resources, applying theory, and employing evidence-based practices become especially important in the field. Making the connection between the classroom and the real-world can be difficult. A common issue is that students and instructors can experience frustration with classroom learning. Students may ask, "When will I ever use this?" or, "How does this apply to real life?" Instructors may ask, "Why are my students not learning the material?" or, "Why are these students so unmotivated?" One promising approach to motivating students and helping them apply knowledge to authentic situations is Problem-Based Learning

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(PBL). Working in groups with authentic or real-world problems can enrich learning as students see how to implement and apply what they learn in current or future career paths. PBL and the family sciences appear to provide a well aligned match in both theory and practice.

Key Features of Problem-Based Learning

PBL methods of education are designed to increase awareness of tasks that are involved in various professional and clinical situations or contexts. Students meet in small groups with a tutor or facilitator who nudges the discussion along. The students are assigned a problem and must research and investigate possible causes and solutions to real scenarios. Using real-world problems or authentic situations encourages reasoning, investigation, and decision-making skills. Developing the understanding of what one knows, what one needs to find out, and knowing where to procure helpful information is an imperative skill for problem-solving in any career field. Hypothesizing potential causes of problems, as well as possible solutions, is another skill fostered through PBL.

Implementing PBL tasks that are authentic and/or similar to real-world challenges in the field can increase student motivation for learning. As students in a chosen field see how they can realistically apply theories and information from the classroom to prospective career tasks, it becomes easier to learn material and is more interesting than simply listening to a lecture and regurgitating information. Learning how to solve problems based on theory and best practices helps students understand and apply classroom information. If students do not connect theory and information from class, courses can be reduced to an exercise in short-term memory.

Other key features that are commonly used in PBL include first presenting the problem, before lecturing or giving information, using authentic or at least realistic problems, employing small groups facilitated by guided questions, and closing the loop, or revisiting what worked well and determining what revisions are necessary. Barrows (1986) suggested that returning to the group and having students evaluate what or how they learned, and even how they could improve learning, is a process he called “closed-loop or reiterative Problem-Based learning” (Barrows, 1986, p. 484). This technique allows students to evaluate learning resources and processes. Some of the intended outcomes and the mechanisms for obtaining these outcomes outlined by Barrows (1986) and implemented in PBL designs include:

- The structuring of knowledge for use in clinical contexts, or situations one might normally encounter in the workplace in a given profession.
- The development of an effective clinical reasoning process, how to go about making decisions and finding solutions to professional situations.
- Using the tutor/facilitator role to enhance group learning guides, questions, and revisits key points but allows students to lead discussion.
- The facilitation of effective self-directed learning skills, such as closing the loop, allows for metacognition and recognition of how peers go about problem solving.
- An increased motivation for learning, because students see real-world applications for the content learned in classes, and that they need to be more prepared for classroom discussions.

- The enablement of self-directed learning through providing ill-structured problems, without a clear formulaic answer; students need to find and evaluate best practices within the literature of perspective fields.
- Closing the loop, or to revisit the learning methods and progression is a process of metacognition. This can include reviewing how one is reasoning and comparing to how others are working through the same problem.

Vygotsky and the Zone of Proximal Development

To aid in explaining the processes occurring within PBL, Vygotsky's Socio-Historical Theory appears to be a good fit. There are many similarities between Barrows' (1986) PBL and Vygotsky's (1978) Socio-Historical Theory, including the Zone of Proximal Development (ZPD), and how Vygotsky suggested scaffolding instruction around small groups, more capable peers, and authentic tasks (tasks that would be done in a real world context).

Vygotsky (1978) added that to understand an individual's learning one must also understand the historical and cultural background of the individual. It is through interaction and individual experiences within his or her culture that one is informed and shapes thoughts, actions, and experiences. A Vygotskian perspective of knowledge would perceive knowledge to be co-constructed between at least two people (Vygotsky, 1978). This theoretical perspective can be applied to problem solving, planning, and abstract thinking because Vygotsky suggested that these processes have a social origin.

Vygotsky posited that higher orders of thinking are attainable. However, to obtain higher-order thinking, an individual must receive instruction. The highest level of thinking for Vygotsky is abstract theoretical reasoning. One way abstract thinking can occur is through problem solving. Crain relayed, "Since this instruction is only widespread in technologically advanced societies, we will find purely abstract thinking prevalent only in these societies" (2005, p. 223). As college students take several classes within certain disciplines which utilize the same theories and concepts, they become better prepared to use abstract and higher level thinking using those disciplines and theories. The learning and developing process occurs through the encountering of continually novel concepts (Gredler & Shields, 2008). As novel or new concepts are encountered, the learner needs to fill in the gaps or create an understanding of the new concept. Solving problems poses an opportunity to use information learned and to gather information that will help to better define problems and to find solutions to those problems.

Key Theoretical Features

Learning is enhanced when it occurs between individuals and within small groups. Vygotsky was "concerned with how such mental functions can occur on the 'intermental' (i.e., socially distributed) as well as 'intramental' (i.e., individual) plane of functioning (Wertsch, 2002, p. 106). He was also concerned with how and when individuals become aware of their own learning and memory processes; what we would call metacognition (Crain, 2005). For socio-cultural theorists, one of the most powerful teaching tools is interaction with peers and the discussion of problem solving techniques and ideas. For example, Miller (2002) suggested "experiences within a more equal relationship may provide opportunities to learn how to take the perspective of others and how to resolve conflicts" (p. 395). At times, students may feel more

comfortable discussing and comparing ideas with peers than with a professor or expert. Allowing and providing opportunities to collaborate with peers can be a very effective learning strategy.

Learning and interacting with peers allows for novel concepts to be introduced and for novel ways of solving problems to be experienced and learned. These intermental processes allow for communication, collaboration, and perspective taking (e.g., seeing how others see the same situation). Peer interaction also allows one to see how others solve problems and can even add insight into how others' intramental processes work. Noticing how others think could also play a role in better understanding how one's own thinking processes unfold. These opportunities can be enhanced and created by understanding a student's ZPD.

Zone of Proximal Development

Vygotsky suggested that an individual's potential for learning or the next level of achievable knowledge is as important as the current level of knowledge. By understanding what level of knowledge a student possesses, what they can achieve individually, and what can be achieved with the help of a more capable peer or instructor, the instructor can evaluate the student's learning potential. The range of tasks which an individual cannot yet accomplish independently, and yet could do with the guidance of adults or more capable peers, or the distance between one's current level of ability and the potential level of ability, is called the ZPD (Vygotsky, 1935). Specifically, Vygotsky defined the ZPD as the "distance between [a child's] actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1981, p. 86). However, Wertsch (1984) pointed out that nowhere in his writings did Vygotsky explain what he meant by "problem-solving under adult guidance or in collaboration with more capable peers" (p. 8), though he maintained that guidance by an adult or more capable peer is an important part of the Vygotskian theory. Learning from someone that has knowledge and experience gives the learner a chance to see how someone else might go about solving the same problem, or see another way of thinking about the same concept. This guidance is most likely from an adult, perhaps a teacher or parent (especially when a child is younger), but can also be a more capable peer, so that many times within a study group, each peer may have some knowledge or experience to share, and the role of the tutor may change depending on the concept being discussed.

It is important to note the individual's ZPD to know what can be learned, in order to design learning objectives that are helpful in pushing the individual to their potential. Vygotsky had an issue with intelligence tests because they measure only what can be done currently, not what can be learned (Vygotsky, 1935). He emphasized the example of two boys who receive the same score on a standardized test, and yet one may be much more capable of learning in a more efficient manner. The learning objectives for these two would be very different knowing what each could accomplish with a little guidance and how quickly each could get to the next level of development. The ZPD is dynamic and fluid. As one learns, the ZPD expands to adapt to new levels of functioning. It is important, therefore, to keep learning objectives just outside of the current zone of development to maintain cognitive growth. As the ZPD continuously

recalibrates, the learning objectives must also develop along with the changing capabilities, interests, and goals of the student.

Some key characteristics of Vygotsky across the ZPD learning and development processes include:

- Occurs when encountering novel concepts; creates a new idea that needs to be processed and understood.
- Intermental: processes social interaction, discussion of cognitive processes and how each has thought about solving the problem. This is the learning and interaction between peers or learners.
- Intramental: processes cognitive processes within the individual. This is the learning and thought processes occurring within the individual.
- Perspective taking of others: seeing how and what others think, how others might solve the same problem or how another might think about the same concept. This process gives the learner a comparison of what others might think or do which can lead to cognitive flexibility. Problem solving/resolving conflicts between group members; creating an opportunity to discuss and hear ideas from others.
- Guidance from a more capable peer (instructor, tutor, classmate).
- Awareness of own learning processes (metacognition) (Vygotsky, 1978; Wertsch, 1984)

Certainly one of the difficulties of establishing the ZPD is finding a task or assessment that can indicate what one can do with and without help. Another problem, especially in some college courses where there are large numbers of students, is that it can be difficult to know where each student currently stands on their own, and what he or she may be able to do with some help or guidance. Establishing an upper limit can also be problematic, as many students may be able to perform certain tasks on their own, yet creating an assessment that can continually push each student to his or her limit may be difficult. Another difficulty can be that problems with clear algorithms or clear answers are easier to assess than problem solving processes that may have several possible answers or unclear answers.

Similarities/Comparisons between PBL and Vygotsky's Scaffolding with ZPD

There are many similarities between these two pedagogies or theories. PBL presents an ill-defined problem to scaffold learning. Striking a balance between too much and too little structure can be difficult, but is necessary. Too much structure would appear to reduce the broad research a student might have to complete to prepare to resolve a problem. Too little structure can lead to the constant gathering of information and perhaps a feeling that the problem is unresolvable. Additionally, the problem design needs to be authentic or relatively real. This will help increase motivation for problem solving because students can see how they would use the information they are discovering.

For Vygotsky and the ZPD, the problem solving ability of the student and their need for help to solve a problem defines the ZPD. The scaffolding of instruction is designed to structure problems slightly out of reach of the students' abilities so that they will need help from a more capable peer or from the instructor. The instructor's help will allow them to stretch into the upper reaches of the zone.

The problems encountered in a PBL context can be similar to ZPD, although Vygotsky may have suggested scaffolding the problem in a well-defined way. He may not have disagreed with an ill-defined problem as suggested in PBL for students who are ready. Ill-defined problems are problems or tasks that do not have either obvious answers or strict algorithms for solving the problem. Barrows (2002) suggested that many times there are several answers or many ways to solve ill-defined problems. A large number of real-world problems are ill-defined in terms of what the problem is and what the solution might be (Hmelo-Silver & Barrows, 2006). Ill-structured or ill-defined problems are presented incompletely and unresolved purposely so that students have the chance to not only generate and discuss multiple views and perceived causes, but also to invent multiple solutions and manners in which to solve the problem (Barrows, 2002; Walker & Leary, 2009). Vygotsky suggested that the problem needs to be within the grasp of a student, but just far enough out of reach to require help to achieve the next level of development or understanding.

Another area of similarity between ZPD and PBL is that of the role of the tutor. In the facilitation of PBL, the tutor takes a guiding role but does not take over the discussion. The tutor might redirect or focus the group on a certain comment to start them down a certain path, but lets the students lead, for the most part. Walker and Leary (2009) suggest that tutors facilitate learning by prompting students with questions. The tutor in a college setting would likely be an instructor but could also be a well-trained teaching assistant, as Barrows describes in medical school problem based learning courses (Barrows, 1986). Tutors are not looking to lecture about content as much as modeling learning processes that lead to problem-solving (Barrows, 2002; Hmelo-Silver & Barrows, 2006). Vygotsky's more capable peer could be compared to the tutor, or it could also be that the instructor could play that role from time to time. Students often learn from one another as much as they might from a teacher. One of the strengths of the small group approach is that classmates also have the chance to teach and learn from one another. Students can see how other students would go about gathering information and problem solving, constituting an intramental process. Instructors, tutors, teaching assistants, or classmates all have a chance to give and receive help from one another. The help given must be minimal enough that the student can replicate it, learn from it, and implement it, and yet be difficult enough that learning occurs. By achieving the structured task, the student's ZPD should expand further.

Vygotsky and others that employ the ZPD use small groups so there is more social interaction, intermental activity, and discussion between group members. Both PBL and ZPD encourage metacognitive processes, although they might be achieved in different manners. The PBL tutor would revisit the problem and talk about the problem solving process. For Vygotsky, the interaction with peers and seeing how they solve problems would help students become aware of their own mental activities. Table 1, Model Comparison, summarizes these similarities in theory and practice below. Notice the similarities between PBL and ZPD with an emphasis on problem solving, social interactions, and the role of the instructor or tutor. These theories and pedagogies are well aligned and support one another.

Table 1

Model Comparisons

Pedagogy/Theory	Problem Based Learning	Zone of Proximal Development
Problem Solving	Ill-defined problem, authentic or relatively plausible situation.	Space between Own solution-solution with help is ZPD, resolve conflicts, perspective taking.
Social Interaction Who can influence learning?	Group comes prepared, models how to prepare, notice how others went about problem solving.	Small groups, more capable peer/s, Intermental processes, culture/society.
Metacognition	Close the loop, revisit problem to reiterate process, how to improve, tutor facilitates.	Awareness of own learning process, Intermental or others' thinking can enhance awareness of own thinking-intramental.
Motivation	Ill-defined increases and authenticity increases motivation.	Authentic Task increases motivation.
Tutor/Instructor	Facilitates discussion, helps focus group, does not take control, lets students lead, revisits process.	Teacher Structures activities around ZPD, scaffolds learning – could also be a more capable peer helping to solve problems, teach.

Research in the Family Sciences

Following are examples of how PBL has been implemented in the family sciences. A discussion of how PBL designs could be used in a classroom, and three examples of how group projects could be implemented around real-world, authentic tasks are provided. There are many ways that PBL can be evaluated and tested. As previously mentioned, many studies have looked at standard testing procedures compared with scores on the same tests with traditional learning. Growing evidence suggests that PBL is equivalent to traditional instructional methods in terms of knowledge and performance on standardized tests, but that those students who participated in PBL also showed greater problem solving skills (Albanese & Mitchell, 1993; Vernon & Blake, 1993). Walker and Leary (2009) completed a meta-analysis of PBL courses and outcomes across multiple disciplines. The researchers found that students who participated in PBL courses performed “either as well or better than their lecture-based counterparts” (Walker & Leary, 2009, p. 24). This was the case in principle based exams, or exams based on theories and concepts more than right or wrong answers, and even more so in application based assessments. The findings showed that the results were stronger in disciplines outside the medical and science fields, like social sciences and liberal arts (Walker & Leary, 2009). This is good news for instructors in the helping professions who are considering the use of PBL in course design.

While much of the literature and impetus for PBL comes from the medical field, these strategies could be continued and applied in other fields as well. Barrows found that the PBL methods which he facilitated and measured are currently being used in many disciplines such as business, education, psychology, economics, architecture, law, engineering, social work, and secondary education (Barrows, 1996).

Several researchers have found PBL applications within the family science fields. Hunts and Marotz-Baden (2004) found that teaching the process of problem solving along with the content encouraged students to make connections to real life problems. The researchers suggested that “teaching problem solving is one [of the] most important tasks if we want our family science students to possess the skills . . . to help solve problems for others” (Hunts & Marotz-Baden, 2004, p. 23). A PBL approach was also developed for an online graduate course in child development in the Family Studies and Human Services department at Kansas State University. The course was structured so that students collaborate in groups online around cases that have occurred or around current events that involve family or developmental issues (Murray, 2002). The researcher reported that student collaboration and quality of homework improved in the PBL format, and that students enjoyed the case study, or PBL, approach in the course (Murray, 2002). Students reported that benefits of participating in the groups’ work to included getting “other people’s points of view” (Murray, 2002, p. 166). These reports support the PBL and Vygotskian perspective that group work and real-world problems create important new opportunities for higher learning.

Ward and Lee (2002) used a Problem-based learning approach to teach a Family and Consumer Science course in a secondary education setting. The researchers maintained that the PBL method “encourages students to look for new solutions to relevant problems using available knowledge and resources . . . [and] expands students’ critical thinking and problem-solving skills” (Ward & Lee, 2002). Other Family Studies researchers and instructors at Samford University posited that, “students learn best if they connect new information to existing knowledge and then use the new knowledge structure in some real-life setting” (Sandifer-Stech & Gerhardt, 2001, p. 1). Sandifer-Stech and Gerhardt proposed that family science educators want for their students to use family theories and research to help families solve problems in the real world (2001). These examples of PBL in the Family Sciences showed that there are many ways to apply the content knowledge to the processes required in the family studies fields, such as problem solving, helping, and gathering resources.

PBL Applications

There are many opportunities for educators, developmental researchers, cognitive scientists, and others in the family sciences to implement studies with PBL and its pedagogical efficacy, but also to determine what other psychological and cognitive processes occur when using PBL. Loyens, Magda, and Rikers (2008) studied the self-directed learning aspect of PBL and compared it with self-regulated learning, and found that both were developmental processes. One study suggested that PBL overlaps with cognitive architecture (Schmidt, Loyens, van Gog, & Paas, 2007). Other cognitive processes like cognitive autonomy, information processing, attention, judging, reasoning, problem solving, among many other processes could be implemented in the PBL research designs.

Others found ways to use PBL in the family therapy classroom to promote problem-solving skills in complex social problems (Lim & Hernandez, 2007). Additionally, others found ways to apply PBL to the training of social workers, as they make clinical and complex decisions and need problem solving techniques and processes (Green & Wilks, 2009; Pearson, Wong, Ho, & Wong, 2007). These are examples of how family science and PBL are well aligned. PBL was designed to encourage the same critical thinking and problem solving skills which medical practitioners use. Critical thinking and problem solving are also vital in many of the helping professions. This similarity may have the most promise, as it is a more direct relation.

Three Examples of PBL in Family Science Courses

Designing course work around applicable, real-life situations is necessary due to the probability that students will likely face these challenges in their careers. In addition, PBL generally increases student motivation and engagement in the classroom (Savery, 2006). Groups can be three to four students, or larger. According to Barrows (1986), groups of six to eight work well. Groups should be small enough to allow all students to discuss the problem and give meaningful input, while large enough to cover the many facets of the problem. One useful strategy is putting students in groups according to their career goals and experience. Finding a common goal or problem to solve based around desired careers helps students connect theory with application in an authentic setting. Some instructors find it useful to provide a worksheet that helps students start the process of problem solving and information gathering. Some of the questions which instructors might ask students to discuss could be:

- “What ideas do you have about the solution to this problem?”
- “What do you know?”
- “What do you need to know?”
- “What do you need to do to gather the necessary information?”
- “What resources do you have?”
- “Who can you ask to find help?”

Students can continue this in an iterative process or a close the loop revisiting (Barrows, 1996) where they refine more and more what solutions would work based on their research (Delisle, 1997).

The following vignettes are examples of how an instructor might use real world scenarios and problems in the family science discipline to assign a PBL project. Using previous experience and current events can add to the variety of problems for students to solve.

Vignette #1

1. You are working in state government in family policy and program development.
2. You have been asked to participate in a task force to improve upon a significant problem that is affecting millions of families today: divorce. Overall, divorce has multiple negative psychological, physiological and economic outcomes for children, individuals,

and society. Therefore, it is imperative that the family policy and program development department come up with a marriage enrichment program that can help prevent divorce.

3. Your task force must come up with an effective marriage enrichment program idea – designed to lower the state’s divorce rates by 5% within 5 years.
4. This program must be implemented at the state level.
5. This department focuses on using theory to guide the process. Because of this philosophy, this program must use evidence based practices and theories to implement this program.
6. Upon completing this project, you will be asked to provide a 20 minute presentation of the program idea to the class as if you were presenting the program to local and state representatives, policy makers, and stake holders.
7. The group must then effectively field questions from the audience (representatives).

Vignette #2

1. You are working as part of special education team in a local school district, which includes school counselors, psychologists, special education teachers, and administrators.
2. Your community leaders have informed you that Hurricane Katrina survivors will be housed in the community for an indefinite amount of time and nearly 80 children will be attending your schools.
3. Your team has been asked to create trainings for teachers and staff in the district, which will help accommodate and improve the lives of the newcomers. It has been asked that you help the district understand the difficulties that trauma survivors face, the psychological difficulties of the disaster, losing their homes, and being uprooted to a new community.
4. You have also been assigned to create programming that can help these students and their parents connect with community resources and provide activities to help them cope with these difficulties.
5. The school district suggests using evidence based practices and theory to guide the process. Because of this policy, this program must use evidenced based practices and theories to implement this program.
6. Upon completing this project, you will be asked to provide a 20-minute presentation of the program idea to the class, as if you were presenting the program to local school board and district administrators.
7. After the presentation, the group must effectively field questions from the audience (representatives).

Vignette #3

1. You are working as part of a multi-agency task force with youth who are aging out of foster care and Child Protective Services. This task force includes workers from the Division of Child and Family Services (DCFS), youth corrections, school districts, the juvenile court, and any other agencies or roles that would be helpful to this age group and population.
2. These youth will be 18 years of age within a year and need help to transition to adult roles and self-sufficient means of support.

3. Your task force has been asked to create a program to help these youth prepare for career choices and training, tasks of daily living and caring for oneself, and providing resources connecting them to community agencies that may be helpful.
4. These agencies suggest using evidence based practices and theory to guide the process. Because of this policy, this program must use evidenced based practices and theories to implement this program.
5. Upon completing this project, you will be asked to provide a 20-minute presentation of the program idea to the class, as if you were presenting the program to local agencies and funders to pilot the program.
6. After the presentation, the group must then effectively field questions from the audience (representatives).

Applying PBL in the Classroom

Allowing students to select the groups with which they would like to work based on their career goals helps students to not only be more motivated but also helps them connect theories from class to authentic problems that they may face in their chosen careers. As the students break up responsibilities and report back to their groups, they get to see how others may have gone about the same tasks. Through active and independent problem solving, students can discover resources in the community and even network with professionals in their desired careers. In addition, revisiting problems and discovering possible solutions helps to “close the loop,” as Barrows (1996) suggests. Furthermore, Delisle (1997) suggests reviewing the process with students or letting the students review the process. For example, some instructors find it useful to revisit these topics over the course of a few weeks. The process of continually evaluating what students know and what they need to know helps the instructor and students revisit topics from class, research from outside of class, and get closer to viable solutions.

Some instructors design the whole classroom experience around solving complex real-world problems across the semester. Some use PBL as the culmination for the final portion of class; for example, having a team collaboration project where results are presented to peers. Other instructors might use problems and small group discussions as a way to discuss theories and course content in an authentic way, so that students can practice thinking about real-world situations in which the theories can and have been applied.

This process of problem solving and discussion helps define the ZPD and move it higher and higher throughout the project. Finding problems that motivate students in authentic learning tasks can be one of the most challenging and enjoyable activities which one can witness in a classroom. A method for streamlining the process is to provide a worksheet with space for generating ideas, reviewing what students know and need to know, and helping to narrow down solutions. This can be very helpful for students and helps them revisit the research questions, the possible answers, and then decide what else they might need to know. Table 2, PBL Group Summation, is an example of a worksheet that incorporates these aforementioned purposes.

Table 2

PBL Group Summation

Session #1	Define the Problem	Possible Solutions	What do you know?	What do you need to know?	Which solution would work best?
Session # 2					
Session # 3					
Session # 4					
Recommendation For Action					

Limitations

PBL has its limitations, however. Finding authentic problems which motivate each student can be time consuming. Creating PBL classroom opportunities takes more up-front work for the instructor than a typical lecture class session. Training students to accept and be open to new methods of teaching can also be challenging. While many studies have shown similar or better test scores (Albanese & Mitchell, 1993; Vernon & Blake, 1993), there are many other valuable outcomes that can and should be studied, such as problem solving, abstract thinking, and facets of cognition that testing alone cannot measure. Therefore, one should take caution in drawing conclusions from this introductory paper until further empirical evidence has been gathered.

Directions for Future Research

There are many promising areas of research that would be fruitful for PBL. Metacognition and metamemory could be studied through encouraging and assisting students to notice their own learning processes. Problem solving abilities and abstract thinking could be studied through PBL techniques. Group psychology and mechanisms of interaction within groups could be better defined and observed. Understanding the cognitive processes occurring, what occurs, and how it develops are also fertile options for researchers and educators. While there are many similarities between PBL and Vygotsky's ZPD, other advantages can be captured in the helping professions. Medical practitioners have used PBL for decades to help them with problem solving and diagnosing patients. Helping professionals in the social and family sciences also need many of these same skills in order to solve problems in their workplaces and communities. Using PBL has great promise in the human service fields. Exploring how to improve the dissemination of these tools and theories through PBL is a good fit in both theory and practice.

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